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AECB STAFF ANNUAL REPORT ON POINT LEPREAU G.S. FOR THE YEAR 1989

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Canada

Report

AECB STAFF ANNUAL REPORT
POINT LEPREAU G.S.
FOR THE YEAR 1989

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1. INTRODUCTION

This report is a review by AECB staff of the operation of Point Lepreau Nuclear Generating Station during 1989. The review is based on information contained in the various documents submitted by New Brunswick Power under the terms of the Operating Licence and on information gathered by AECB staff during routine site monitoring, inspections and audits.

2. STATION OPERATION

The station operated at high power during the majority of the year, generating a total of 5.65 TWh (gross), corresponding to a gross capacity factor of 94.8%. The plant was shutdown in April for a 20 day planned maintenance outage. During the outage, pressure tube K05 was replaced in order to permit destructive examination of an in-service tube, and ten pressure tubes were scrape sampled to determine deuterium pick up concentration.

3. AECB STAFF REVIEW OF OPERATION

3.1 Station Compliance

There were no observed non-compliances with the conditions of the Reactor Operating Licence during the year.

3.2 Quarterly Reports

Reports of station operation were submitted by NB Power, as required by the conditions of the Reactor Operating Licence (ROL 5/88, Condition A.A.22). AECB staff has reviewed these reports in detail and concludes that the licensee has reported comprehensively and accurately.

3.3 Radiation Protection

There were no exposures greater than regulatory limits during the year. The total dose expenditure was 1370 person-mSv shallow dose and 1252 person-mSv deep dose. Of the deep dose, approximately 34% was attributed to tritium exposure. This dose expenditure is higher than that occurring in 1988 (702 person-mSv deep dose). The majority of this increase in dose expenditure occurred during the station's annual maintenance outage (850 person-mSv compared with 460 mSv for the 1988 annual outage), when dose intensive work such as pressure tube scrape sampling and the removal of pressure tube K05 for examination was completed.

The dose distribution was:

Dose	Number of Persons	
	1989	1988
0 to 0.19 mSv	666	760
0.2 to 5 mSv	305	310
5.1 to 10 mSv	70	30
10.1 to 15 mSv	14	5
15.1 to 20 mSv	5	1

There were no exposures exceeding 20 mSv.

3.4 Station Effluents and Environmental Monitoring

3.4.1 Station Effluents

Gaseous effluent activity totaled 1.6E-2% of the Derived Emission Limit (DEL) during the year. The most significant radionuclides detected were tritium (1.3E-2% DEL), Carbon-14 (2.6E-3% DEL) and I-131 (1.9E-4% DEL). The airborne releases correspond to a dose of 0.8 μSv to an individual in the critical group at a distance of 1 kilometre from the station.

The liquid effluent activity release rate was 1.5E-3% DEL for 1988. This corresponds to a dose of 0.08 μSv to a member of the critical group.

3.4.2 Environmental Monitoring

The environmental monitoring program was conducted satisfactorily during 1989. There was no dose recorded at the environmental TLD sites which could be attributed to station operation. The only radionuclide found by the environmental monitoring program which can be related to the operation of Point Lepreau is trace quantities of tritium in air.

3.5 Process Systems

There were no serious process system failures in 1989. (A serious process system failure is defined as a failure which requires the operation of one or more of the special safety systems to prevent fuel failures and/or the release of fission products).

Highlights relating to process system operation during the year are:

- Heavy water leakage from tubing associated with the delayed neutron monitoring system required repair in May. These tubes are exhibiting signs of fretting damage in areas where they are grouped together.

- Installation of primary heat transport pump trip: A trip to ensure that primary heat transport pumps are shutdown if low primary heat transport pressure occurs for a sustained period was installed during the 1989 annual outage. This trip is intended to ensure that void induced pump vibrations do not affect heat transport pipework integrity in the event of a loss of coolant accident.

- The motor of primary heat transport system pump 3 was changed in order to assess its condition after seven years of operation. Motor condition was found to be excellent.

- The secondary side pipework inspection program was continued, with inspections being completed at sixteen sites on the main steam lines, with no significant problems found. Replacement of carbon steel pipework in the extraction steam system with stainless steel was also continued. The original material had been found to have been subject to significant wall thinning due to erosion. Feedwater chemistry changes made in 1988 appear to have been successful in reducing the rate of erosion on susceptible components.

- Difficulties were experienced with the generation of unusual amounts of radiolytic hydrogen in the shield cooling cover gas system. The problem appeared to be associated with the ingress of resin fines to the shield cooling circuit.

3.6 Performance of Special Safety Systems

During 1989, SDS1 and containment were both subject to problems which affected their availability. SDS1 moderator temperature trip sensors were found to have a longer time response than design, and since the time response had never been tested, the situation must be presumed to have existed since the trip was installed in 1986. Although NB Power has shown that this fault did not reduce the effectiveness of the trip for design basis accidents, the fault has been reported, in accordance with AECB policy, as an unavailability of SDS1, since the trip was not operated within its design requirements.

Containment was subject to significant unavailability during 1989, due mainly to a single problem with leaking containment isolation valves. The reliability and maintainability of these valves requires improvement based on 1989 performance.

As indicated in Attachment A to this report, lifetime availability performance of the special safety systems is poor, particularly the emergency core cooling and containment functions. AECB staff considers that appropriate steps will have to be taken by the licensee to ensure that these systems meet their availability requirements in the future.

AECB staff notes that problems affecting the performance of special safety systems were also experienced at the Gentilly 2 generating station. These are discussed in the 1989 AECB staff Annual Report for the Gentilly station.

3.6.1 Impact of Current Maintenance Practices on Availability of Special Safety Systems

For the operation of the special safety systems, the highest possible standards are required. AECB staff has observed that, during 1989, these operating standards have not been aggressively pursued by NB Power. An example occurred in 1989, when calibration calculations for SDS1 and SDS2 pressuriser low level trip transmitters were found to be incorrect, introducing a small offset in the level indications (see Attachment B, UER89-09). Although this was a problem of some significance, since it affected all six shutdown system channels, (a common mode fault), NB Power did not take prompt action to recalibrate the transmitters, or to obtain an assessment of the safety impact of operation with the existing calibrations. However, once this problem became apparent, NB Power did institute additional training for technical section personnel to increase the level of awareness of safety and licensing requirements.

As a result of discussions on this topic, AECB staff became aware that one SDS2 pressuriser low level transmitter had an additional small offset in the unsafe direction - a situation which had apparently existed since commissioning without being rectified. This fault was traced to incorrect installation of the transmitter reference tubing.

Although operation in 1990 is beyond the scope of this report, AECB staff notes that the established pattern of special safety system problems appears to be continuing. For example, when the cause of the inaccurate SDS2 pressuriser level transmitter indication was found and rectified in February 1990, it was accidentally recalibrated to the old, faulty calibration calculations instead of the corrected ones. Additionally, during March 1990, it was discovered that a number of pressure transmitters in special safety systems had been fitted with incorrect electronics during maintenance, or had had their time response incorrectly set.

3.6.2 Use of Analysis Techniques For Reliability Assessments

AECB staff has noted that NB Power makes only limited use of techniques which would facilitate the detection of undesirable trends in component reliability, and enable control to be maintained of the probability of incurring future system unavailability. AECB staff considers that these techniques are also necessary to evaluate maintenance practices which have resulted in the redundancy of a special safety system being reduced, and which therefore would increase the probability of system unavailability.

NB Power has indicated that it will be taking a number of initiatives to increase the level of safety awareness of staff, to improve the formal definition of functional requirements for safety related equipment, and to extend analysis of system performance to facilitate the rectification of component reliability problems before they impact system availability.

3.7 Significant Events

Twelve events reportable under the conditions of the Point Lepreau Operating Licence occurred during 1989, and were promptly reported to the AECB as required. However, immediate reports can only give limited information concerning an event, and therefore AECB staff has instituted a standing requirement for the submission of a full Unplanned Event Report (UER) within 20 days of the event. To date NB Power has submitted Unplanned Event Reports for eight of the twelve events, and the average delay for submitting these reports was more than four months. AECB staff considers such delays to be excessive.

A description of each of these events is included as Attachment B to this report.

3.8 Quality Assurance

In January 1989, in conjunction with New Brunswick Department of Labour staff, AECB staff conducted an audit of a portion of the licensee's Quality Assurance Program, concentrating on system surveillance testing. In July, a review of the activities, training and responsibilities of NB Power quality assurance staff was completed. There were no significant deficiencies found in either case.

3.9 Station Maintenance

The station maintenance program was conducted satisfactorily during the year. Station staff completed approximately 7800 scheduled maintenance items, corresponding to about 90% of the maintenance items originally scheduled for the year. Unscheduled work totalled about 10600 items. AECB staff considers that execution of the plant maintenance program has been controlled to acceptable standards during 1989.

3.10 Chemistry Control

There were no significant problems experienced in maintaining station chemistry control during the year. Changes made to secondary side water chemistry in 1988 appear to be having the desired beneficial effect on erosion and corrosion rates in components of secondary systems.

3.11 Station Management

No changes in AECB approved management positions took place during 1989.

3.12 Training

NB Power personnel achieved a success rate of 78% in 18 candidate examinations towards obtaining AECB authorizations as shift supervisors or control room operators. NB Power will start construction of an administration annex in 1990, which will house the new control room simulator. The simulator is scheduled to be operational in 1991.

3.13 Emergency Exercises and Drills

Three of five shift crews participated in emergency exercises or drills during the year. Four crews received contingency training in the use of chemical protection suits. Since shift crews participate in exercises or training on an eighteen or twenty four month basis, this level of activity is approximately in accordance with the target.

3.14 Security

One security related incident occurred in 1989, as described in Attachment B. Additionally, AECB security staff conducted an inspection of the Point Lepreau security arrangements in July 1989. Security at the station was found to be generally satisfactory, but a number of improvements are being discussed with NB Power.

3.15 AECB Staff Inspections

Throughout the year, AECB staff monitored station operation, and conducted inspections of station operation, maintenance and administration. In addition, AECB staff conducted detailed field inspections of the state of equipment in various reactor systems. There were no significant safety-related deficiencies identified by these latter inspections.

3.16 Measures of Station Performance

Indicators of the quality of overall station operation have been tabulated in Attachment A with the corresponding 1988 information included for comparison.

4. SIGNIFICANT LICENSING MATTERS

During 1989, AECB staff opened fourteen action items to be addressed by NB Power and 11 action items were completed and closed. At the end of the year, twenty eight action items remained incomplete. AECB staff is concerned that the time taken to respond to some of these items is excessive. As noted in section 3.7, above, submission of formal Event Reports has also frequently been late. These features indicate that NB Power needs to re-examine either the resourcing or the organisation of some safety and compliance functions.

The following sections identify important licensing issues which directly affect safe operation of the station:

4.1 Licence Renewal

The current Operating Licence expires on June 30 1990.

4.2 Containment Leak Rate Testing

On the recommendation of AECB staff, the Board approved an amendment to the current Point Lepreau Operating Licence, permitting an extension in the period allowed before the completion of a containment pressure test at design pressure to December 31 1990 (BMD89-174). During 1989, NB Power completed application of new liner material to 43% of the reactor building interior walls, and commissioned a system to return containment leakage air from the spent fuel discharge bay back to the containment envelope. Testing in 1990 has shown that the containment now has a leakage rate below 0.5% of contained volume per day.

4.3 Follow-Up To Chernobyl Accident

At the end of 1988, three topics relating to the AECB staff review required responses from NB Power. Two of these concerned analyses to demonstrate shutdown system effectiveness under accident conditions with abnormal flux shapes, and the third concerned the use of handswitches to block reactor safety functions. A reply has now been received from NB Power with respect to the use of blocking handswitches, and this response is currently being reviewed by AECB staff.

In response to the two analysis related items, NB Power has initiated a program of re-analysis of a number of transient conditions and reactivity configurations to evaluate the performance of the shutdown systems. A report covering SDS1 has been completed, and is currently being reviewed by AECB staff. The report concludes that SDS1 is fully effective for all the cases studied. A similar report for SDS2 is in preparation, and is expected to be ready early in 1991.

4.4 Steam and Feedwater Line Failures in the Turbine Building

During 1989, NB Power completed modifications to the turbine building which are intended to limit the consequences of the failure of a large steam or feed line failure in the turbine hall. The structural strengthening installed should enable the building to remain intact for failures corresponding to 50% of full power turbine steam flow. NB Power has also proposed stationing an operator in areas which would not be at risk from such an accident, to ensure the availability of staff to operate safety equipment in the event of such an accident. However, no progress has been made to date in implementing this proposal. NB Power has also proposed ventilation studies to examine ways in which safety related equipment in vulnerable areas could be further protected, and ways in which the hot steam atmosphere could be mitigated following such an event.

5. CONCLUSIONS

5.1 AECB staff considers that the Point Lepreau Generating Station has been generally operated and managed safely during 1989.

5.2 The lifetime availability performance of the four special safety systems is poor, and the initiatives NB Power is proposing to improve this performance will need to be pursued aggressively to ensure that these systems meet their availability requirements in the future.

5.3 Slow response to AECB action items, and excessive delays in the production of full reports for events reportable under the Operating Licence indicate a need for NB Power to examine the organisation and resourcing of some of its safety and compliance functions

ATTACHMENT A - SUMMARY OF STATION PERFORMANCE INDICATORS

POINT LEPREAU G.S. - 1989

		1989	1988	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT
A. Radiation Control				
Total deep dose		1252 person-mSv	703 person-mSv	A
Total shallow dose		1370 person-mSv	814 person-mSv	A
Total extremity dose		783 person mSv	29 person-mSv	A
Total F/H deep dose		156 person-mSv	112 person-mSv	A
Total F/H shallow dose		160 person-mSv	116 person-mSv	A
Total neutron dose		126 person-mSv	58 person-mSv	A
Number of exposures > regulatory limits		0	0	A
Number of radiation related investigations		3	1	A
Releases from the station				
a) Airborne				
Tritium:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	1.3 E-2	1.4 E-2	A

		1989	1988	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT)
Releases from the station (cont'd)				
Noble gas:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	0	9.6E-5	A
Iodine 131:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	1.9E-4	1.8E-3	A
Particulates:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	0	0	A
b) Waterborne				
Tritium:	No of months >1% DEL	0	0	A
	Average % DEL for year	6.8E-4	2.5E-4	A
Gross Beta-Gamma	No of months >1% DEL	0	0	A
	Average % DEL for year	8.3 E-4	7.2E-4	A

	1989	1988		AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT)
Environmental Measurements				
Average boundary dose rate[1] resulting from emissions	0.88μSv/y	0.85μSv/y		A
Mean boundary tritium in air	<1 Bq/m^3	<1 Bq/m^3		A
B. Plant Control				
Number of completed reactor trips	0	0		A
Number of serious process failures	0	0		A
Special safety system unavailability (years/year) (Target: 1.0E-3 years/year)	1989	1988	LIFETIME	
SDS1	0.22	1.0[2]	0.39	NI[3]
SDS1 (without fault discussed in UER 89-02)	0.2 E-3	0.0	3.8E-5	
SDS2	0.23E-3	0.0	0.12[4]	NI
CONTAINMENT	0.12	0.12E-3	17E-3	NI
ECCS	0.09E-3	39.0E-3	6.6E-3	NI

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[1] These are calculated values, based on average plant emissions. The actual background dose at the exclusion zone boundary is about 800 μSv/yr.

[2] Based on unavailability of moderator temperature trip, reported in 1989.

[3] See Section 3.6

[4] Lifetime performance is dominated by an incident that occurred during the first year of plant operation (failure of a valve to meet its seismic requirements).

	1989	1988	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT (UR=UNDER REVIEW)
Number of safety related/ support systems not meeting availability target	1[1]	1	A
Number of reportable incidents	12	5	A
Number of fires	0	0	A
Number of significant operator errors in reportable incidents	4	0	A[2]
AECB compliance inspections "unsatisfactory"	0	0	A
Number of forced outages	0	0	A
C. Plant Administration			
Documentation			
Average number of temporary operating instructions in force	11	28	A
Number of systems with more than one temporary operating instruction in force	0	4	A
Average number of temporary instructions behind schedule for review	4	0	A
Total number of outstanding call ups (as of 17 May 1990)	444	NA[3]	UR
- on safety systems only	32	NA	UR
- on standby safety support systems	20	NA	UR
Total number of outstanding work orders (as of 17 May 1990)	1180	NA	UR
- on safety systems only	56	NA	UR
- on standby safety supports systems	99	NA	UR

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1 See UER89-01 in Attachment B

2 This indicator now includes events for which the operator had a significant contribution. In 1988 and previously it referred to those events where the operator was the initiating cause.

3 NA = Not available

AECB STAFF COMMENTS
(A=ACCEPTABLE)
(NI=NEEDS IMPROVEMENT)

D. Operation

Control room operating standard	A
Field operator standard	A
Chemical control	A
Radiation control	A
Housekeeping	A
Quality assurance program	A

ATTACHMENT B - SUMMARY OF REPORTABLE EVENTS

POINT LEPREAU G.S. - 1989

UER 89-01: Liquid Zone Control Return Valve Failure

This failure was discovered during the annual outage and would have caused the zones to drain on loss of liquid zone control pumps, leading to a potential loss of regulation incident requiring shutdown system action.

UER 89-02: Slow response of SDS1 Moderator Temperature Trip

Poor thermal contact between the moderator temperature trip sensors and the wall of the moderator pipe caused a response delay of up to 20 minutes. The design value for this trip was 3 minutes. NB Power has since demonstrated that SDS1 trip coverage was maintained for design basis accidents in spite of this fault.

UER 89-03: Carbon 14 Contamination

Three workers were contaminated with C-14 during work on the horizontal flux detectors. The maximum dose for the most affected individual was assessed as an extremity dose of 75 mSv to the hands, with no significant whole body dose. The event showed procedural inadequacies in the assessment of contamination hazards at the job site, which could have led to doses in excess of the statutory limits.

UER 89-04: Moderator D2O Spill into the Vapour Recovery System

During the 1989 annual outage, the moderator ion exchange deuteration/ dedeuteration vent tank was overfilled, causing moderator heavy water to be spilled via the vent connection into the vapour recovery system. This, together with a problem in vapour recovery drier operation, caused a rapid increase in tritium levels in the reactor building, reaching a maximum of approximately 400 Derived Air Concentration. Since outage maintenance work was in progress in the reactor building, this incident had the potential of causing significant accidental exposures to workers.

UER 89-05: Failure of Containment Isolation Intervalve leak test

During a regularly scheduled interspace leak test both isolation valves of a containment penetration were found leaking when the valve interspace could not be pressurized to the required test pressure. Following adjustments to ensure both valves were correctly seated, the problem was rectified and the test successfully completed.

UER 89-06: Standby Generator SG1 Load Sequencer Problems

A problem with standby generator SG1 feeder breaker revealed a fault with the automatic load sequencing logic that could have resulted in some loads not being energised under emergency conditions.

UER89-07: Problems with Neutron Over Power Trip Coverage While Derated

In November, a reactor power derating to 70% took place to allow work on the electrical grid connection to New England. Subsequent review of the transient indicated that trip confidence for both SDS1 and SDS2 neutron overpower trips may have been below the required value for approximately two hours.

UER 89-08: Access Control Problem

During an alarm summary review by the control room operator it was noted that an access control alarm was active. Subsequent investigation revealed that both east and west fuelling machine lock doors were open without the access keys being inserted. The event revealed design and procedural deficiencies that could have led to an accidental radiation exposure.

UER 89-09[1]: Errors in Pressurizer Level Indications

Routine checking showed the spread of pressurizer level measurements between channels G, H and J to be outside specified limits. The observation led to the discovery of calibration errors that resulted in the SDS1 and SDS2 pressurizer level measurements being inaccurate. NB Power was able to demonstrate that these errors did not cause a reduction in required trip effectiveness.

UER 89-10[1]: Dropping of CO2 Cylinder

A cylinder of liquid CO2 was dropped during hoisting operations in the east fuelling machine vault resulting in a discharge of CO2 to the area. This was a near miss accident which could have caused direct injury or asphyxiation hazards to workers in the vault area.

UER 89-11[1]: Security Threat

In December, a warning was received from the Maine Yankee utility of a threat from a individual who had been arrested in Maine. The individual claimed to be part of a terrorist group, who intended to take action against a Canadian nuclear facility in order to secure the release of several Colombians in prison in New Brunswick. Security measures were taken, and RCMP response initiated. The threat was determined to be a hoax on the following day.

UER 89-12[1]: Failure of ECC Valve MV75 Logic

MV75 is a valve which permits the emergency water system to supply water to the heat transport system under accident conditions. During emergency core cooling operation, the valve is required to be closed, to prevent recirculation of medium pressure injection flow back to the recovery pumps' suction. Under test, the valve failed to close as required; however, since the normal operating state of this valve is in the closed position, the fault would only have affected ECC capability for the short time the valve was open under test.

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1 Reports still to be submitted